

*Spring 1999 Wetlands
Mitigation Monitoring
Report*

Kin-Buc Landfill Site
Edison, New Jersey

August 1999



TECHNICAL REPORT

Spring 1999 Wetlands Mitigation Monitoring Report

Kin-Buc Landfill Site
Edison, New Jersey

August 1999

BBL

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

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1. Introduction

This Wetlands Mitigation Monitoring Report summarizes monitoring activities associated with the enhanced tidal wetlands area adjacent to Operable Unit (OU) 1 at the Kin-Buc Landfill in Edison, New Jersey. The Spring 1999 monitoring episode conducted in May represents the first semi-annual monitoring event of 1999, the second year of a five-year semi-annual wetland mitigation monitoring program.

The purpose of this monitoring report is to provide an indication of the presence and extent of vegetative growth and to document the status of enhanced wetlands following completion of tidal wetland mitigation area preparation activities in April 1998. The report includes relevant background information, a discussion of mitigation project goals and methodologies, and a summary of mitigation monitoring results. The report also summarizes monitoring data trends, and compares the status of the enhanced wetlands with the mitigation objectives discussed below.

1.1 Project Background

The Kin-Buc Landfill site is an inactive, closed municipal solid waste and industrial waste landfill located adjacent to the Raritan River in Edison Township, Middlesex County, New Jersey (Figure 1-1). The entire site occupies approximately 220 acres, and is bounded to the north by an industrial park; to the west by the Raritan River; and to the east by Edmonds Creek, which drains an area of tidal wetlands before discharging to the Raritan River. About 600 feet to the south is the Edison Township Municipal Landfill.

Landfilling began at the site in about 1947, although it was not until 1968 that Kin-Buc, Inc. began operating the site. Landfill activities ceased in 1976, and in 1981 the site was added to the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as Superfund.

Between 1983 and 1991, Kin-Buc, Inc. and SCA Services, Inc. (SCA) conducted a Remedial Investigation/Feasibility Study (RI/FS). The findings of the RI/FS resulted in a Record of Decision (ROD) from the United States Environmental Protection Agency (USEPA) that separated the site into two remedial areas known as OU1 and OU2. OU1 consisted of the Kin-Buc Landfill I mound, the Kin-Buc Landfill II mound, the Pool C Area, and portions of the Low-Lying Area between Kin-Buc I and Edison Township Landfill. OU2 consisted of the Edmonds Creek Marsh Area, Mill Brook, Martins Creek, Mound B, and portions of the Low-Lying Area. The remedial action (RA) for OU2 involved cleanup of polychlorinated biphenyls (PCBs) in sediment to a level of 5 parts per million (ppm).

Implementation of the OU1 RA began in April 1994, and was completed by the end of September 1995. The OU1 RA involved the disruption of approximately 3.56 acres of tidal wetlands and 1.38 acres of freshwater wetlands, leading to a requirement for wetlands mitigation. The wetlands mitigation work involved enhancement of approximately 11 acres of *Phragmites*-dominated tidal marsh east of Edmonds Creek (Figures 1-2 and 1-3). Mitigation activities conducted to date include the installation of a boundary ditch (hydrologic barrier) to inhibit *Phragmites* rhizomes from spreading into the mitigation area, spraying the *Phragmites* with a systemic herbicide (Rodeo®) to control this invasive species, and removal of dead stalks by cutting and grinding. This work has created conditions that are allowing the natural recolonization of the marsh with desirable wetland species from the existing seed bank. These wetland mitigation activities have led to the current requirement for monitoring of the enhanced wetlands area beginning in the spring of 1998.

1.2 Mitigation Project Goals

The goals of the wetland mitigation project have been established based on communications between SCA and the USEPA and Trustees, including letters to the USEPA dated November 25, 1997; February 20, 1998; and April 17, 1998, and respective USEPA responses dated February 10, 1998; April 9, 1998; and May 21, 1998. Based on these communications, the goals of the mitigation project are:

- to meet (or match) the expected type of wetlands system for this area based on an evaluation of historically-disturbed tidal areas within OU2; and
- 85 percent coverage of the mitigation area after five years by an indigenous tidal wetland community.

The OU1 tidal mitigation area will be considered successful after five years or less if 85 percent coverage by a wetland community, including, but not limited to, those indigenous species identified in Section 1.3, is observed.

The vegetative coverage goal of 85 percent will be scaled over the initial five-year monitoring period such that a rate of 10 to 20 percent coverage per growing season (i.e., 20 percent coverage after the first growing season, 40 percent coverage after two growing seasons, 60 percent after three, 75 percent after four, and 85 percent after five years) is realized. Assuming a mitigation area of 10+ acres translates into approximately 2 acres, 4 acres, 6 acres, 8 acres, and 9 acres coverage for the respective growing seasons.

After five years of monitoring (by Fall 2002), if the natural recolonization approach combined with potential interim seeding/planting activities has not allowed a sufficient level of growth to exclude *Phragmites* or does not meet the expected 85 percent coverage by a tidal wetlands community, a revised contingency plan that includes planting of tidal wetland species will be implemented. The revised contingency plan would be prepared based on site-specific information/data generated from mitigation monitoring events. The dominant plant type associated with the wetland community is anticipated to be *Spartina* species.

The status of the enhanced wetland will be reviewed at the conclusion of the five-year monitoring period. Based on the success of the mitigation project in meeting the established goals, the following outcomes are possible:

- continuation of the established monitoring program; or
- revision of the monitoring program.

The Fall 2002 progress report shall indicate an appropriate course of action for future monitoring activities associated with the tidal mitigation area. The course of action will likely involve additional monitoring for a minimum of three years to ensure that the established wetland is self-sufficient.

1.3 Wetland Mitigation Monitoring

The monitoring program, established to verify and document the success of the mitigation, includes site inspections during the May and September growing seasons for a period of five years starting from completion of mitigation site preparation activities (Spring 1998), and progress reports summarizing the results of the inspections.

Site inspections will involve the following activities:

- photograph the enhanced wetlands;
- characterize plant species composition;
- conduct a qualitative evaluation of wetland value and functions;
- visually inspect the mitigation area for signs of erosion;
- note observations of wildlife presence and grazing or predation of wetlands vegetation; and

-
- survey spot elevations at 15 locations throughout the mitigation area (fall only).

Section 2 presents the results of the Spring 1999 site inspection, and Section 3 provides conclusions and recommendations regarding problems encountered. In addition, the surveying of spot elevations throughout the mitigation area is scheduled to be conducted during fall site inspections only.

A re-evaluation of the OU2 mitigation area was conducted prior to commencement of the wetland monitoring program to assess the plant species that have regrown and can be expected to be present in the seed bank of the OU1 mitigation area. Based on results of this evaluation, the following species can be expected in the seed bank of OU1:

- eastern false-willow (*Baccharis halimifolia*);
- big-leaf sumpweed (*Iva frutescens*);
- switch grass (*Panicum virgatum*);
- dwarf spike rush (*Eleocharis parvula*);
- saltmeadow cordgrass (*Spartina patens*);
- salt marsh fleabane (*Pluchea purpurascens*);
- perennial saltmarsh aster (*Aster tenuifolius*);
- black grass (*Juncus girardii*);
- seashore saltgrass (*Distichlis spicata*);
- three square (*Scirpus olneyi*);
- seaside goldenrod (*Solidago sempervirens*);
- smooth cordgrass (*Spartina alterniflora*);
- big cordgrass (*Spartina cynosuroides*);
- marsh mallow (*Hibiscus moscheutos*);
- salt marsh bulrush (*Scirpus robustus*); and
- marsh orach (*Atriplex patula*).

It should be noted that the OU2 wetlands area was disturbed during the RA in the early 1990s, but has recovered to support a natural regrowth of diverse tidal wetland vegetation. As a result of the relatively recent disturbance of the OU2 wetlands, the vegetative regrowth may be successional and may not represent a "climax community". However, those species currently observed are desirable from a wildlife habitat standpoint and the species composition likely contains the specie(s) that will be present in the marsh climax community.

2. Mitigation Monitoring Results

2.1 Supplemental Mitigation Project Activities

Spot application of the herbicide Rodeo® will be used to control *Phragmites* regrowth in the mitigation area on an "as needed" basis during the initial five-year monitoring period. Based on observations of *Phragmites* regrowth during the Fall 1998 monitoring event, an additional herbicide application and associated stalk removal was recommended.

2.1.1 Supplemental Herbicide Application

In October 1998, Allied Biological, Inc. (Allied) was contracted to conduct an additional application of the systemic herbicide (Rodeo®) to control *Phragmites* regrowth in portions of the mitigation area. Rodeo® was applied to all areas where *Phragmites* regrowth was notably visible to the Allied crew. Most of the dense *Phragmites* regrowth was occurring along the outer edges of the mitigation area.

The Allied crew used a hand-held sprayer mounted on an all-terrain vehicle to spray areas that were visibly overgrown with *Phragmites*. In order to limit the spraying of more desirable wetland plant species growing in the mitigation area, back-pack sprayers were used in areas with less *Phragmites* growth.

2.1.2 Supplemental Stalk Removal

In association with the supplemental herbicide spraying, Allied was contracted to cut the resulting dead *Phragmites* stalks. The stalk removal work took place in February 1999.

The stalk removal was accomplished by using a Posi-Trak machine equipped with a front-mounted "brush hog" cutting unit that cuts and grinds the dead stalks. In denser *Phragmites* stands, some of the stalks were cut and knocked down with no subsequent grinding. However, the left over plant debris, whether ground or not, is then susceptible to removal by tidal action.

The Posi-Trak machine was used for cutting larger areas where the dead *Phragmites* stalks were very dense. Hand-held, gas-powered cutters were used for cutting the remaining stalks in areas where desirable plant species were growing among the *Phragmites*.

2.2 Mitigation Site Inspection

The Spring 1999 site inspection was conducted in accordance with the April 1998 Wetlands Mitigation Monitoring Plan for Kin-Buc OU1 [Blasland, Bouck & Lee, Inc. (BBL), 1998], and broadly accepted ecological field monitoring methodologies (Smith, 1974; Kent, 1994; Sutherland, 1996). Results of the site inspection are presented below. Because of substantial differences in seasonal growing patterns, data trends and relative comparisons of vegetative data are described using a comparison of the results from the Spring 1999 monitoring event with results from the Spring 1998 monitoring event.

2.2.1 Photographing Wetlands

The enhanced wetlands were photographed from eight fixed points to document the current status of the mitigation project, and identify important changes in wetlands structure, if any. Figure 1-2 indicates locations of reference photographs, which are provided in Attachment 1. A variety of locations have been selected to provide adequate coverage of the mitigation area. The location on top of the Edison Landfill mound (photograph 8) provides a panoramic view of the mitigation area, another location is an area slightly elevated above the mitigation area (photograph 5), and remaining locations occur at, or near, ground level around the mitigation area boundary. The

May 1999 photographs are similar to the May 1998 photographs, with the exception of a decreased presence of *Phragmites* observable in certain photographs. Comparisons of photographs taken at these fixed locations will continue to be made from year to year and reported in the periodic monitoring reports to provide an indication of the progress of the mitigation project.

2.2.2 Characterization of Plant Species Composition

A total of 57 one-meter by one-meter quadrats were evenly distributed to the extent possible along five transects to assess vegetation in the OU1 mitigation area. Figure 1-3 indicates the location of transects and sample quadrats. Transects A, B, C, D, and E have 5, 10, 15, 14, and 13 quadrats, respectively, at intervals of approximately 50 to 75 feet, depending on the transect. The northern boundary of the mitigation area forms the baseline from which transects were projected in a southeasterly direction toward the Raritan River. It should be noted that the location of the initial transect (Transect A) along the baseline was randomly selected using a random numbers table. Remaining transects were located at even intervals along the baseline from the random starting point. In addition, the location of the first quadrat along each transect was randomly selected in a similar manner and remaining quadrats were spaced at even intervals along the transects from the random starting point.

Wetland plant species composition was characterized through visual identification of vegetation species. Sampling of the mitigation areas was conducted using visual estimates of vegetative cover in one-meter by one-meter framed quadrats (Sutherland, 1996). Percent cover and average height of species within the major height strata were visually estimated and recorded. The percent coverage values assigned to each plant species (or bare ground, water, etc.) within a quadrat ranged from less than one percent (<1 percent) through 100 percent coverage, with 10 percent increments in between [exceptions were made in some quadrats where 5 percent increments were used (e.g. 25 percent or 95 percent)].

Percent cover results for quadrat sampling during the Spring 1999 monitoring event were reported for low growing ground vegetation, as well as for taller species growing up through the shorter vegetation (e.g., *Spartina cynosuroides* and *Scirpus robustus*). As a result, greater than 100 percent coverage is reported in various quadrats depending on the types of vegetation present (Sutherland, 1996).

Percent cover of dead plant debris was also recorded during the Spring 1999 monitoring event. In addition, the species of dead plant debris present in each quadrat was noted. Not all dead plant debris was composed of *Phragmites* stalks.

The vegetation monitoring field data sheets used during the site inspections are provided in Attachment 2. This field data sheet was completed by filling in the transect identification, noting the presence of listed (or other) species of vegetation, making wildlife observations, and visually identifying the percent cover and average height of the major height strata.

Total percent coverage for each quadrat was calculated by adding together all non-*Phragmites* living plant coverages within the quadrat for a total quadrat percent coverage (for ease of adding, <1 percent values were discounted and <10 percent values were given a standard value of 5 percent). Total percent coverage for each transect was calculated by averaging the total percent coverages of each of the quadrats in that particular transect (any quadrats that actually had over 100 percent live non-*Phragmites* plant cover were counted as 100 percent for averaging purposes). Total percent coverage for the entire mitigation area was calculated by averaging the total percent coverages of each of the quadrats in the entire area.

Plant species present in the quadrats at the mitigation site during the Spring 1999 inspection include the following:

Scientific Name	Common Name
<i>Atriplex patula</i>	Marsh Orach
<i>Distichlis spicata</i>	Seashore Saltgrass
<i>Eleocharis parvula</i>	Dwarf Spikerush
<i>Iva frutescens</i>	Big Leaf Sumpweed
<i>Phragmites australis</i>	Common or Giant Reed
<i>Pluchea purpurascens</i>	Saltmarsh Fleabane
<i>Salicornia europaea</i>	Pickleweed
<i>Scirpus robustus</i>	Saltmarsh Bulrush
<i>Solidago sempervirens</i>	Seaside Goldenrod
<i>Spartina alterniflora</i>	Smooth Cordgrass
<i>Spartina patens</i>	Saltmeadow Cordgrass
<i>Spartina cynosuroides</i>	Big Cordgrass
<i>Teucrium canadense</i>	Wood Sage

With the exception of Pickleweed and Wood Sage, all of the above species have previously been observed in the OU2 mitigation area (Section 1.3).

2.2.3 Qualitative Evaluation of Functions

Before mitigation work began, *Phragmites australis* covered 100 percent of the mitigation area. As a result of the Rodeo® application, *Phragmites* has been greatly reduced in the mitigation area. However, *Phragmites* regrowth has occurred in certain areas; the species was observed in 27 out of 57 sampling quadrats for a relative frequency of 0.47. Even though *Phragmites* was observed in nearly half of the sampling quadrats, the average percent coverage of *Phragmites* calculated from the total number of sampling quadrats was only 7.5 percent. Because of this regrowth, an additional spot application of Rodeo® was conducted in limited portions of the mitigation area in early July 1999, and additional stalk cutting activities are planned for Fall 1999.

A number of species are continuing to colonize the area, as reflected in the sampling data presented in Attachment 2. *Atriplex patula*, *Eleocharis parvula*, *Salicornia europaea*, *Scirpus robustus*, *Spartina alterniflora*, and *Spartina patens* are six species seen at percent coverages of 50 percent or greater in some of the quadrats that were sampled. Additionally, *Atriplex patula*, *Pluchea purpurascens*, and *Spartina patens* had relative frequencies of 0.44, 0.30, and 0.23, respectively.

A more detailed assessment of growth patterns and a figure showing low marsh and high marsh vegetation associations and species variations will be provided in the Fall 1999 Monitoring Report at the end of the growing season, when conditions are best for making these observations.

2.2.4 Inspection of Boundary Ditch

The mitigation site boundary ditch was visually inspected to identify areas of erosion, if any, and to verify its function as a hydrologic barrier to inhibit *Phragmites* invasion into the mitigation area. Representative photographs of the ditch were taken and are included in Attachment 1. The integrity of the boundary ditch was sound and it appeared to function as an effective barrier to the *Phragmites* (photographs 1, 2, and 7). Some erosion was noted in the boundary ditch along its length, resulting in a slight overall widening of the ditch. Otherwise, no significant changes were observed since the Fall 1998 monitoring event.

2.2.5 Erosion Monitoring

Visual erosion monitoring at the site included potential washout areas and sediment deposition areas associated with the prepared, partially-vegetated mitigation area. The engineered ditch and the two existing ditches in the mitigation area have eroded slightly since the removal of the *Phragmites*. Some small channels have been forming in certain sections of the mitigation area that are susceptible to flooding during high tide events. These small channels, which drain open areas into the nearest ditch, were noted during the Spring 1999 inspection.

2.2.6 Observations of Wildlife

Observations of wildlife presence by visual or audio identification and other indicators, such as nests, scat, and tracks were noted during the Spring 1999 inspection. Observations on the grazing or predation of wetlands vegetation were also made. Minimal predation of *Spartina alterniflora* by Canada Geese was observed in areas where the geese have access to the mitigation area. The observed predation of the *alterniflora* was markedly less than was observed during the Fall 1998 monitoring event. Wildlife species present at and around the mitigation site during the Spring 1999 inspection include the following:

Scientific Name	Common Name	Evidence
BIRDS		
<i>Anas platyrhynchos</i>	Mallard Duck	Sighting
<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	Sighting
<i>Branta canadensis</i>	Canada Goose	Sighting, Tracks, Scat
<i>Buteo jamaicensis</i>	Red-Tailed Hawk	Sighting
<i>Cistothorus palustris</i>	Marsh Wren	Sighting, Calls
<i>Corvus brachyrhincos</i>	American Crow	Sighting
<i>Larus argentatus</i>	Herring Gull	Sighting
<i>Tringa melanoleuca</i>	Greater Yellowlegs	Sighting
<i>Tyrannus tyrannus</i>	Eastern Kingbird	Sighting
MAMMALS		
<i>Odocoileus virginianus</i>	Whitetail Deer	Tracks, scats
<i>Ondatra zibethicus</i>	Muskrat	Tracks, scats
<i>Procyon lotor</i>	Raccoon	Tracks

Scientific Name	Common Name	Evidence
<i>Ratus norvegicus</i>	Norway Rat	Tracks
REPTILES		
<i>Chelydra serpentina</i>	Snapping Turtle	Sighting
<i>Malaclemys terrapin</i>	Eastern Diamondback Terrapin	Sighting
INVERTEBRATES		
<i>Melampus bidentatus</i>	Salt Marsh Snail	Sighting
<i>Uca minax</i>	Red-Jointed Fiddler Crab	Sighting, burrows
<i>Uca pugilator</i>	Sand Fiddler Crab	Sighting, burrows

2.3 Spot Elevation Surveying

Spot elevation surveying was conducted during the Fall 1998 site inspection and reported in the Fall 1998 Monitoring Report. A summary of mitigation site survey data is provided in Table 1. Locations and elevations of surveyed transects and quadrats are included in Figure 1-3.

The topography elevations (non-quadrat elevations) indicated in Figures 1-2 and 1-3 of past reports were derived from aerial photographs of the site and surrounding area and served as a general estimate of site elevations. The topography elevations indicated in Figure 1-3 of this report have been updated based on actual surveyed spot elevations using site-specific elevation control. The surveyed topography identified in Figure 1-3 will be used for all future comparisons of elevation in the mitigation area. These elevation comparisons will be reported in future monitoring reports.

2.4 Data Trends

As expected after the initial herbicide application in 1997, the mitigation area is no longer dominated by *Phragmites australis*. Additional herbicide application and stalk removal activities in the fall of 1998 and winter of 1999, respectively, have further reduced the presence of *Phragmites* in the mitigation area. With ample space now created, other plant species are continuing to colonize the area. No single species was observed to be dominating the recolonization of the treated mitigation area. However, six plant species are now observed at percent coverages of 50 percent and greater compared to only three plant species observed at these levels in May 1998. Some patterns of vegetative regrowth were evident. *Spartina patens* seems to be more prevalent in the northwestern portion of the mitigation area while *Salicornia europaea* is more prevalent in the southeastern portion. A large stand of *Spartina cynosuroides* was noted near the southern end of Transect A and a large stand of *Spartina alterniflora* was noted between Transects D and E approximately midway along their length. As mentioned earlier, a more detailed assessment of growth patterns, low marsh and high marsh vegetation associations, and species variations will be provided in the Fall 1999 Monitoring Report at the end of the growing season, when conditions are best for making these observations.

2.5 Comparison of Current Wetland Status With Wetland Restoration Goals

The treated mitigation area has developed an adequate amount of vegetative coverage during the first growing season and into the second growing season, in terms of the restoration goals. Percent coverages (non-*Phragmites* species)

for each quadrat along a given transect were averaged to identify an average percent coverage for each transect. The averages were as follows: Transect A = 47 percent, Transect B = 54.5 percent, Transect C = 24.3 percent, Transect D = 23.9 percent, and Transect E = 14.6 percent. In addition, the average percent coverage of the entire mitigation area based on individual quadrat averaging was calculated to be approximately 29.3 percent. An average percent coverage for the mitigation area was not calculated in Spring 1998 due to the lack of sufficient herbaceous cover. However, the total percent coverage reported above (29.3 percent), almost matches the total percent coverage seen at the end of the 1998 growing season as reported in the Fall 1998 Monitoring Report. The vegetative coverage goal of 40 percent after the second year will be reviewed based on the results of the Fall 1999 monitoring event, after the completion of the second growing season.



WASTE MANAGEMENT

VIA FEDERAL EXPRESS

August 18, 1999

Ms. Grisell V. Diaz-Cotto
New Jersey Remediation Branch
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, NY 10007-1860

Re: Progress Report - Wetlands
Mitigation Project
Kin-Buc Landfill Superfund Site

Dear Ms. Diaz-Cotto:

Attached please find two (2) copies of the Progress Report for the Wetlands Mitigation Project. The report was prepared on behalf of the Respondents by Blasland, Bouck & Lee of the Cranbury, New Jersey office. Kris D. Hallinger of BB & L is the project manager for this work.

Please call me if you have any questions at (201) 465-9100.

Sincerely,

Representing SCA Services, Inc., and Kin-Buc, Inc.,

A handwritten signature in blue ink, appearing to read 'Carl Januszkiewicz', is written over the typed name and title.

Carl Januszkiewicz
Alternate Facility Coordinator

cc: Carole Petersen
Ian R. Curtis - NJDEP
Dennis Duryea - WEOS
Steve Joyce - SCA
William Dodge - EMCON
Kris D. Hallinger - BB & L

3. Conclusions and Recommendations

The Spring 1999 monitoring event identified an increased number of plant species and increased coverage by these species in the OU1 tidal wetland mitigation area compared to the previous spring time monitoring event in May 1998. The following conclusions were reached based on the Spring 1999 data:

- The control of *Phragmites* in the area by means of multiple herbicide applications has been effective although some minimal regrowth of *Phragmites* is occurring at certain locations within the mitigation area.
- Erosion in the mitigation and boundary ditch appeared minimal and the boundary ditch appears to be inhibiting the spread of *Phragmites* rhizomes into the mitigation area from the surrounding *Phragmites*-dominated marsh.
- Natural recolonization of the area has continued with *Atriplex patula*, *Pluchea purpurascens*, and *Spartina patens* representing the most prevalent regrowth species.
- Slight predation of *Spartina alterniflora* by Canada Geese was observed in areas where the geese have access to the mitigation area. The Spring predation was less than the predation observed during the Fall monitoring event, and does not appear to represent a threat to the re-colonization of the tidal marsh.
- Recolonization of the mitigation area appears to be progressing with little or no interference from dead *Phragmites* debris left as a result of the herbicide application and the associated stalk removal (cutting) activities. Tidal conditions are expected to continue to be sufficient to remove the dead vegetative matter over time.

Based on these conclusions, the following is recommended:

- supplemental spot application of Rodeo® herbicide following the Fall 1999 monitoring event;
- continued monitoring of predation of *Spartina alterniflora* during future monitoring events; and
- continued monitoring of the presence of dead *Phragmites* debris on the mitigation area during future monitoring events.

4. References

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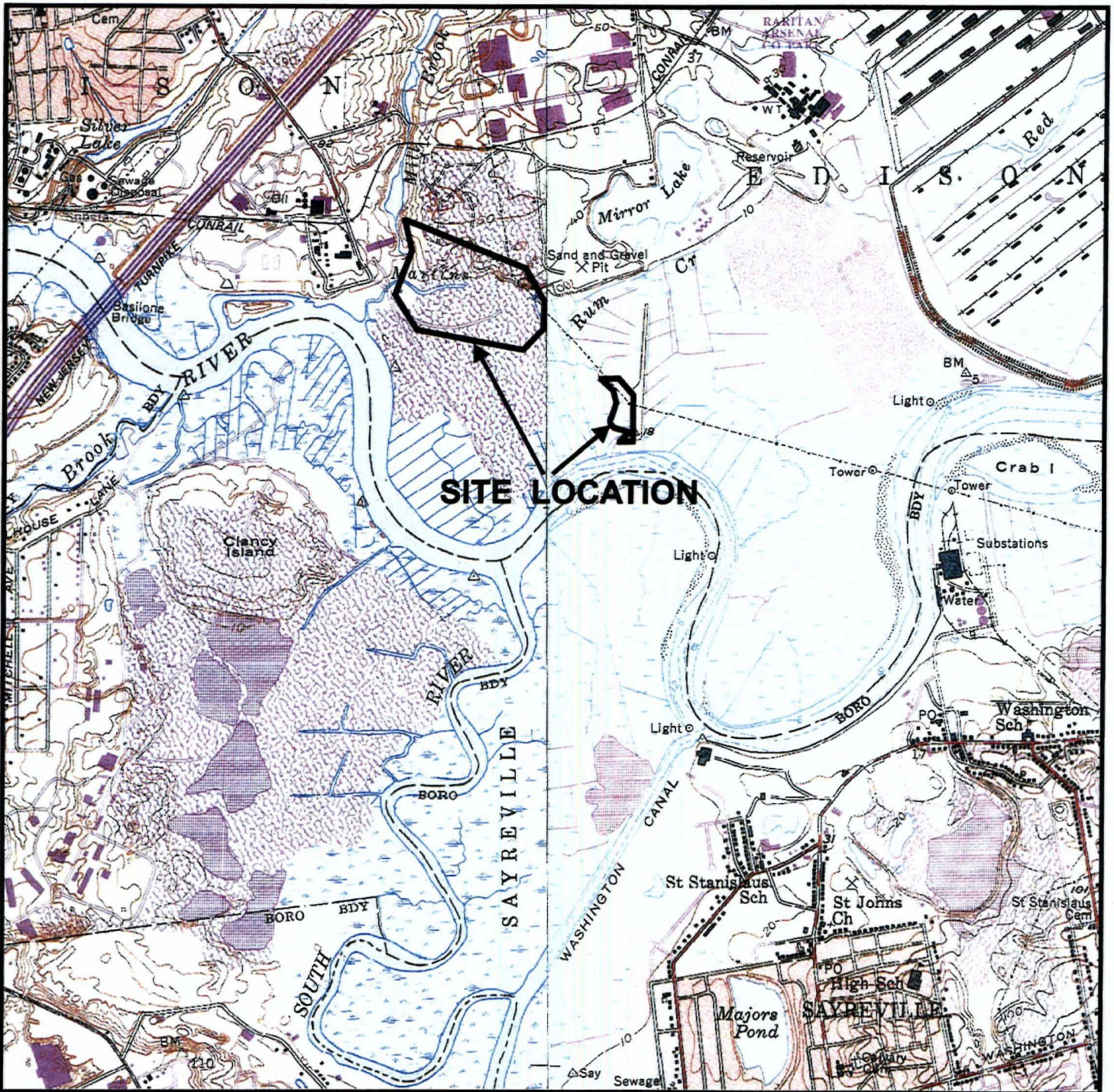
Table 1
Mitigation Site Elevation Data
Kln-Buc Landfill
OU1 Tidal Wetland Mitigation Project

Description	Survey Point	Northing	Easting	Elevation
A5	77	601846.3721	527712.9162	3.8000
A2	78	601879.8002	527697.9496	4.1400
A3	79	601914.3	527678.5376	4.2000
A2	80	601948.6259	527657.4890	4.3100
A1	81	601981.1205	527634.9394	4.2500
A-NO NO.	82	602025.0273	527606.2843	3.8700
B1	83	602018.1609	527711.4165	3.9700
B2	84	601982.3237	527729.6479	4.2200
B3	85	601947.2938	527748.7765	4.2100
B4	86	601912.7537	527766.8353	3.5700
C2	87	601934.7514	527809.4162	3.6800
C1	88	602010.9097	527774.6655	3.8400
D1	89	602013.2596	527839.8006	3.5600
D2	90	601952.8254	527872.8095	3.6400
E1	91	602034.5583	527920.8811	3.6700
E2	92	601975.6304	527953.9798	4.1400
B6	93	601850.8436	527797.3401	4.1600
B7	94	601814.0283	527815.6349	4.3400
B8	95	601777.8530	527832.6145	4.4700
B9	96	601741.6718	527850.2269	4.0600
B10	97	601706.3651	527869.0307	4.4700
TRANSECT B	98	601692.3596	527874.6806	2.6900
C10	99	601455.6919	528019.5120	4.1200
C11	100	601357.7367	528057.5189	3.8700
C12	101	601311.4143	528073.0224	3.9700
C13	102	601244.9303	528096.5731	4.1200
C14	103	601179.1079	528117.5517	4.3200
C15	104	601113.1108	528143.9512	4.6200
TRANSECT-C	105	601099.3768	528148.0421	3.8700
TRANSECT-D	106	601407.2529	528175.6247	5.2700
D14	107	601429.1555	528166.0125	5.2000
D13	108	601473.3041	528140.9790	3.7200
D12	109	601515.3401	528115.7595	3.8700
TRANSECT-E	110	601484.7318	528204.3468	4.5700
E13	111	601497.2	528199.9224	3.8700
E12	112	601531.6816	528182.0217	3.8200
E11	113	601576.9758	528160.3612	3.2200
E10	114	601620.6862	528137.3532	4.1200
E9	115	601666.2484	528116.5099	3.9700
E8	116	601713.2812	528096.9540	3.9200
E7	117	601758.6195	528076.8549	3.5700
E6	118	601803.7680	528056.3653	2.5700
E5	119	601847.1097	528031.8113	3.0900
E4	120	601890.3208	528007.4638	3.3700
E3	121	601933.6399	527981.2781	4.0000
D3	122	601909.1009	527896.7524	3.4400
D4	123	601864.7864	527921.3041	3.0700

**Table 1 (Cont.)
Mitigation Site Elevation Data
Kln-Buc Landfill
OU1 Tidal Wetland Mitigation Project**

Description	Survey Point	Northing	Easting	Elevation
D5	124	601820.7741	527944.5887	3.2800
D6	125	601777.2359	527966.9254	3.4200
D7	126	601733.3291	527992.7995	3.6900
D8	127	601690.3651	528016.6100	3.8800
D9	128	601646.0998	528042.0498	3.9700
D10	129	601602.5552	528066.0378	4.2000
D11	130	601558.5219	528089.6780	4.2600
C9	131	601521.7518	527990.4078	4.3200
C8	132	601583.1713	527960.6637	4.3600
C7	133	601647.2597	527935.2516	4.3200
C6	134	601712.3327	527908.7657	4.5000
C5	135	601758.3100	527890.0637	4.2100
C4	136	601804.3205	527868.7959	4.0800
C3	137	601849.4056	527848.8681	3.7400
TRANSECT-A	138	601842.5430	527713.6786	3.7200

Note: Elevation presented as feet above mean sea level (MSL)



SOURCE:

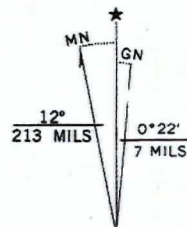
SOUTH AMBOY/NEW BRUNSWICK, NEW JERSEY
7.5 MINUTE QUADRANGLE
CONTOUR INTERVAL = 10 FEET

2000' 0 2000'

Approximate Scale: In Feet



QUADRANGLE LOCATION



UTM GRID AND 1981 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

KIN-BUC LANDFILL
EDISON, NEW JERSEY

OU1 WETLANDS MITIGATION SITE

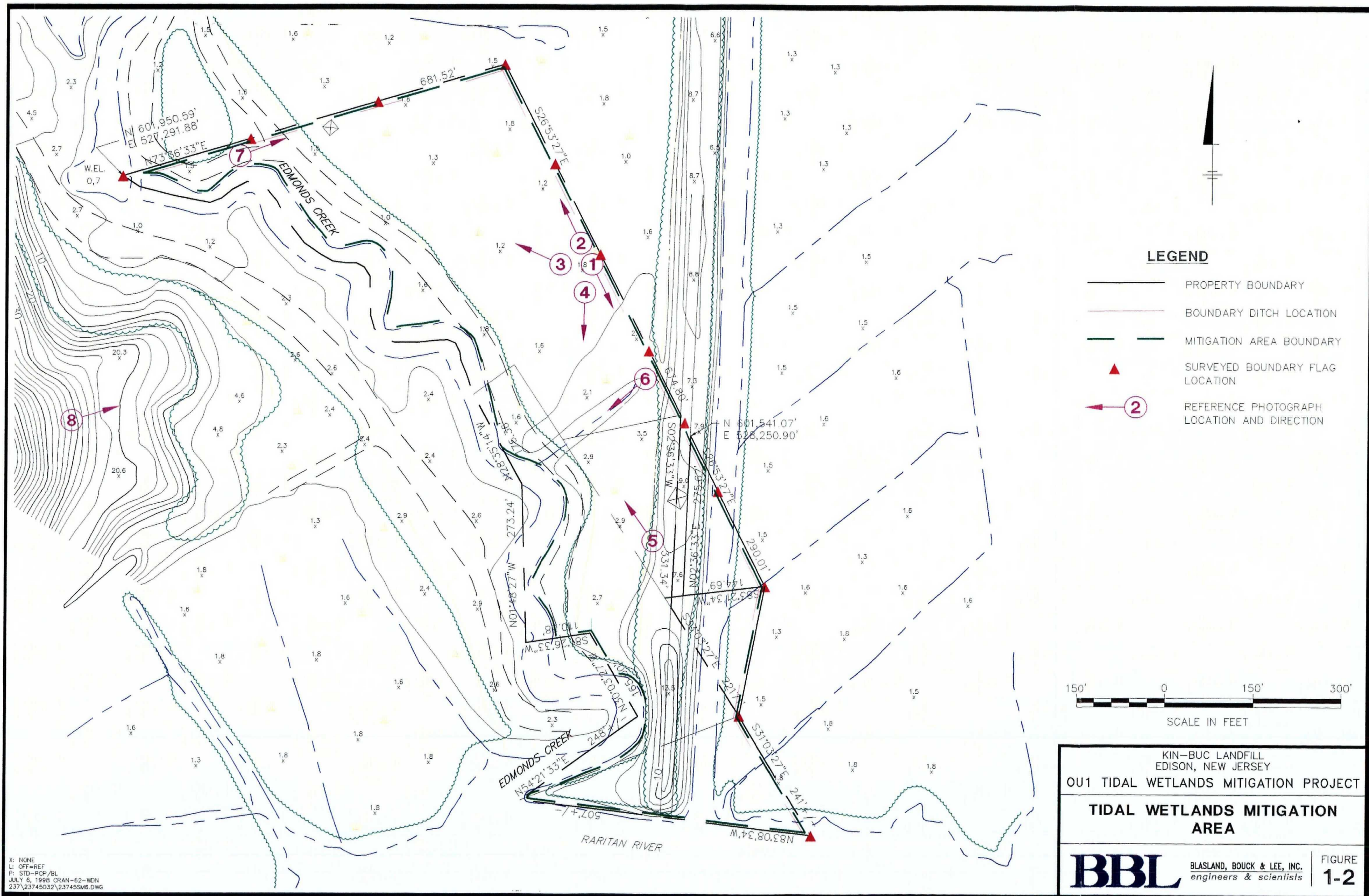
SITE LOCATION MAP

BBL

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
1-1

07/99 EMN
08791596.cdr



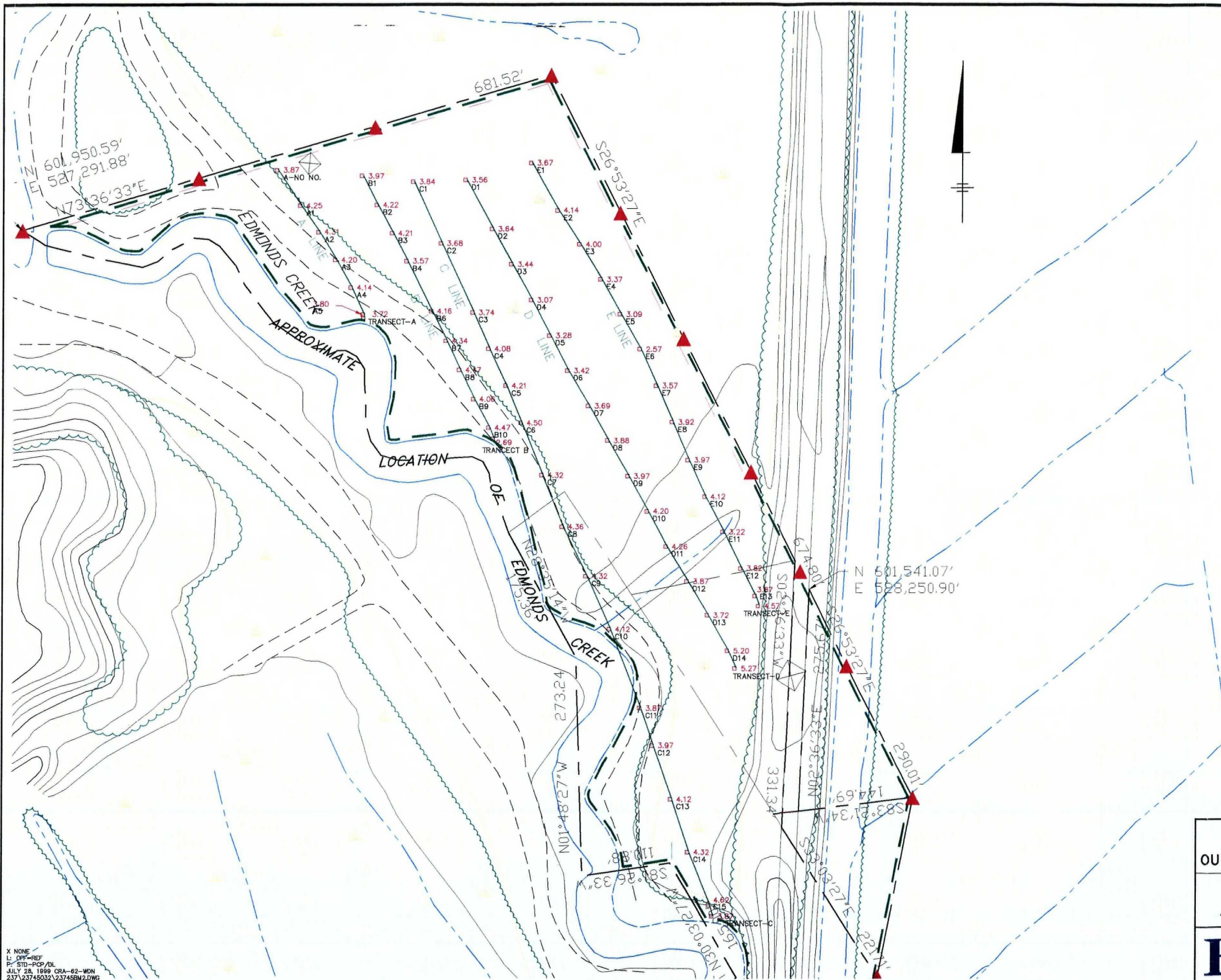
X: NONE
L: OFF=REF
P: STD=PCP/BL
JULY 6, 1998 CRAN-62-WON
237\23745032\237455M6.DWG

KIN-BUC LANDFILL
EDISON, NEW JERSEY
OU1 TIDAL WETLANDS MITIGATION PROJECT

**TIDAL WETLANDS MITIGATION
AREA**

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
1-2



- LEGEND**
- QUADRAT LOCATION
 - TRANSECT LINE
 - 5.20 ELEVATION (FEET IN MEAN SEA LEVEL)
 - B1 QUADRANT DESCRIPTION
 - PROPERTY BOUNDARY
 - - - BOUNDARY DITCH LOCATION
 - - - MITIGATION AREA BOUNDARY
 - ▲ SURVEYED BOUNDARY FLAG LOCATION

KIN-BUC LANDFILL
EDISON, NEW JERSEY

OU1 TIDAL WETLANDS MITIGATION PROJECT

**TIDAL WETLANDS MITIGATION
AREA MONITORING LOCATIONS**

BBL BLASLAND, BOUCK & LEE, INC.
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FIGURE
1-3

X NONE
L: OFF-REF
P: STD-POP/DL
JULY 28, 1999 CRA-02-WDN
237\23745032\237458M2.DWG

ATTACHMENT 1
MITIGATION AREA PHOTOGRAPHS

KIN-BUC LANDFILL
EDISON, NEW JERSEY
SEMI-ANNUAL OU1 WETLANDS MITIGATION MONITORING REPORT

MITIGATION AREA PHOTOGRAPHS
MAY 1999



Photograph 1 - A southeast view along the boundary ditch bordering the eastern edge of the mitigation area. Rodeo®-treated marsh is on right side of ditch, and untreated marsh is on left.



Photograph 2 - A northwest view along the boundary ditch bordering the eastern edge of the mitigation area. Rodeo®-treated marsh is on left side of ditch, and untreated marsh is on right.

KIN-BUC LANDFILL
EDISON, NEW JERSEY
SEMI-ANNUAL OUI WETLANDS MITIGATION MONITORING REPORT

MITIGATION AREA PHOTOGRAPHS
MAY 1999



Photograph 3 - A westerly view across the mitigation area with Kin-Buc Landfill in the background.



Photograph 4 - A southerly view across the mitigation area.

KIN-BUC LANDFILL
EDISON, NEW JERSEY
SEMI-ANNUAL OUI WETLANDS MITIGATION MONITORING REPORT

MITIGATION AREA PHOTOGRAPHS
MAY 1999



Photograph 5 - A northwest view across the mitigation area with Kin-Buc Landfill in the background.



Photograph 6 - A southwest view along a mosquito ditch crossing the mitigation area.

**KIN-BUC LANDFILL
EDISON, NEW JERSEY
SEMI-ANNUAL OUI WETLANDS MITIGATION MONITORING REPORT**

**MITIGATION AREA PHOTOGRAPHS
MAY 1999**



Photograph 7 - A northeast view along the boundary ditch bordering the northern edge of the mitigation area.



Photograph 8 - A northeast view from the top of Edison Landfill across the mitigation area with upland hedgerow in background.

ATTACHMENT 2
FIELD SAMPLING DATA SHEETS

Transect A Date: 5/20/99 and 5/28/99 Investigators: Dr. Joseph Shisler and Chris Koulouzakis Weather: Sunny, 60's to 70's

Weather: Sunny; 60's to 70's

F:\PROJECTS\KINBU\WETLANDS\MONITRNG\1999\SPRING\SPRING99.WB2

**KIN-BUC OU-1 TIDAL WETLANDS MITIGATION PROJECT
VEGETATION MONITORING
FIELD DATA SHEET**

Date: 5/20/99 and 5/28/99

Investigators:

Dr. Joseph Shisler and Chris Koutouzakis

Weather: Sunny, 60's to 70's

		Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10	
Scientific Name	Common Name	%	Ht.	%	Ht.	%	Ht.	%	Ht.	%	Ht.	%	Ht.	%	Ht.	%	Ht.	%	Ht.	%	Ht.
<i>Amaranthus cannabinus</i>	water hemp																				
<i>Aster tenuifolius</i>	saltmarsh aster																				
<i>Atriplex patula</i>	marsh orach									<1	<6"	<10	<6"							40	6"
<i>Distichlis spicata</i>	seashore saltgrass	10	1'													25	1'	10	1'	10	1'
<i>Eleocharis halophila</i>	saltmarsh spikerush																				
<i>Eleocharis parvula</i>	dwarf spikerush																	<1	<6"		
<i>Hibiscus moscheutos</i>	marsh mallow																				
<i>Iva frutescens</i>	big leaf sumpweed											<1	<1'								
<i>Juncus gerardi</i>	black grass																				
<i>Phragmites australis</i>	giant reed									30	2'	20	1'			50	3'	10	2'		
<i>Pluchea purpurascens</i>	saltmarsh fleabane																	<1	<6"	<10	<6"
<i>Salicornia europaea</i>	pickleweed																				
<i>Scirpus americanus</i>	chainrush																				
<i>Scirpus robustus</i>	saltmarsh bulrush											30	2'							<10	1"
<i>Solidago sempervirens</i>	seaside goldenrod																				
<i>Spartina alterniflora</i>	smooth cordgrass																				
<i>Spartina patens</i>	saltmeadow cordgrass	80	1'	50	1'	70	1'			<1	<6"			80	1'	25	1'	40	1'	90	1'
<i>Spartina cynosuroides</i>	big cordgrass															20	2'				
Other Species:																					
Fiddler Crab Holes								20		30											
Algal Mat																		10			
dead plant debris		10(SP)		50(SP)						10(PA)		30(PA)		20(SP)		20(DS)					
bare ground						30		100		60		20						30			

Wildlife Observations: Deer tracks were observed near quadrat B-10.

Notes: (SP) - Approximately 90% of the dead debris was *Spartina patens*.

(PA) - Approximately 90% of the dead debris was *Phragmites australis*.

(DS) - Approximately 90% of the dead debris was *Distichlis spicata*.

Q1 = quadrat number

% = percent coverage

HT = Height (in feet or inches as noted)

KIN-BUC OU-1 TIDAL WETLANDS MITIGATION PROJECT
VEGETATION MONITORING
FIELD DATA SHEET

Transect: C

Date: 5/20/99 and 5/28/99

Investigators: Dr. Joseph Shisler and Chris Koutouzakis

Weather: Sunny, 60's to 70's

Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10	
		%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht
<i>Amaranthus cannabinus</i>	water hemp																				
<i>Aster tenuifolius</i>	saltmarsh aster																				
<i>Atropis palula</i>	marsh orch													<10	<6"	10	<6"	<1	<6"	<10	<6"
<i>Distichlis spicata</i>	seashore saltgrass													30	1'						
<i>Eleocharis halophila</i>	saltmarsh spikerush																				
<i>Eleocharis parvula</i>	dwarf spikerush	50	<6"			<10	<6"														
<i>Hibiscus moscheutos</i>	marsh mallow																				
<i>Iva frutescens</i>	big leaf sumpweed																				
<i>Juncus gerardi</i>	black grass																				
<i>Phragmites australis</i>	giant reed	<1	1'					<10	2'	<10	2'	80	3'	40	3'	50	3'	<1	1'		
<i>Pluchea purpurascens</i>	saltmarsh fleabane							<1	<6"												
<i>Sakornia europaea</i>	pickleweed																				
<i>Scirpus americanus</i>	chairush																				
<i>Scirpus robustus</i>	saltmarsh bulrush																				
<i>Solidago sempervirens</i>	seaside goldenrod																				
<i>Spartina alterniflora</i>	smooth cordgrass																				
<i>Spartina patens</i>	saltmeadow cordgrass																				
<i>Spartina cynosuroides</i>	big cordgrass																				
Other Species																					
Algal Mat		90				100															
Fiddler Crab Holes*												10		20				4		25	
dead plant debris				50(PA)														30(PA)			
bare ground				50				95		95		20		30		40		70		95	

Wildlife Observations: Deer tracks observed near quadrat C-6.

Notes: (PA) - Approximately 90% of the dead debris was *Phragmites australis*.

Q1 = quadrat number
% = percent coverage
Ht = Height (in feet or inches as noted)
* = Number per quadrat

Transect C

Investigators:

Dr. Joseph Shisler and Chris Koutouzakos

Weather: Sunny, 60's to 70's

Wildlife Observations

Notes

Some *Scirpus robustus* was planted east of quadrat C-13 and C-14, and in a wet area between C-12 and C-13.

(PA) - Approximately 90% of the dead debris was *Phragmites australis*.

Q1 = quadrat number

% = percent coverage

Ht = Height (in feet or inches as noted)

* = Number per quadrat

KIN-BUC OU-1 TIDAL WETLANDS MITIGATION PROJECT
VEGETATION MONITORING
FIELD DATA SHEET

Transect D

Date 5/20/99 and 5/28/99

Investigators

Dr. Joseph Shisler and Chris Koutouzakos

Weather: Sunny, 60's to 70's

Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10	
		%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht
<i>Amaranthus cannabinus</i>	water hemp																				
<i>Aster tenuifolius</i>	saltmarsh aster																				
<i>Atriplex patula</i>	marsh orach	10	6"	<1	<6"	<1	<6"														
<i>Distichlis spicata</i>	seashore saltgrass																				
<i>Eleocharis naiophila</i>	saltmarsh spikerush																				
<i>Eleocharis parvula</i>	dwarf spikerush	<1	<6"			<1	<6"														
<i>Hibiscus moscheutos</i>	marsh mallow																				
<i>Iva frutescens</i>	big leaf sumpweed																				
<i>Juncus gerardi</i>	black grass																				
<i>Phragmites australis</i>	giant reed	10	1'	<1	1'					20	2'	10	2'	10	3'					10	3'
<i>Pluchea purpurascens</i>	saltmarsh fleabane	10	<6"									<10	<6"	10	<6"	10	<6"	10	<6"		
<i>Salicornia europaea</i>	pickleweed																				
<i>Scirpus americanus</i>	chairush																				
<i>Scirpus robustus</i>	saltmarsh bulrush													20	1'						
<i>Solidago sempervirens</i>	seaside goldenrod																				
<i>Spartina alterniflora</i>	smooth cordgrass							10	1'	50	1'										
<i>Spartina patens</i>	saltmeadow cordgrass																	50	1'	80	1'
<i>Spartina cynosuroides</i>	big cordgrass																				
Other Species																					
Standing Water								20				20									
Fiddler Crab Holes*		5		1		2															
Algal Bloom		90		60		90		70		30		20		80		100		40			
dead plant debris				10(PA)				10(PA)		50(SA)										10(SP)	
bare ground		<10		30		10															

Wildlife Observations

Notes Seeded quadrat D-8 and between quadrats D-1 and D-2 with *Scirpus robustus* (PA) - Approximately 90% of the dead debris was *Phragmites australis* (SP) - Approximately 90% of the dead debris was *Spartina patens*
Seeded near quadrat D-1 with *Hibiscus moscheutos* (SA) - Approximately 90% of the dead debris was *Spartina alterniflora*.

Q1 = quadrat number
% = percent coverage
Ht = Height (in feet or inches as noted)
* = Number per quadrat

KIN-BUC OU-1 TIDAL WETLANDS MITIGATION PROJECT
VEGETATION MONITORING
FIELD DATA SHEET

Transect D

Date 5/20/99 and 5/28/99

Investigators Dr. Joseph Shisler and Chris Koutouzakis

Weather: Sunny; 60's to 70's

[illegible]

Wildlife Observations Eastern Kingbirds observed perched on quadrat markers

Notes (PA) - Approximately 90% of the dead debris was *Phragmites australis*

Q1 = quadrat number
% = percent coverage
Ht = Height (in feet or inches as noted)
* = Number per quadrat

KIN-BUC OU-1 TIDAL WETLANDS MITIGATION PROJECT
VEGETATION MONITORING
FIELD DATA SHEET

Transect E

Date 5/20/99 and 5/28/99

Investigators Dr. Joseph Shisler and Chris Koutouzakos

Weather: Sunny; 60's to 70's

Scientific Name	Common Name	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10	
		%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht	%	Ht
<i>Amaranthus cannabinus</i>	water hemp																				
<i>Aster tenuifolius</i>	saltmarsh aster																				
<i>Atriplex patula</i>	marsh orach	<1	<6"					<10	<6"	<1	<6"			<1	<6"	<10	<6"			30	<6"
<i>Distichlis spicata</i>	seashore saltgrass																				
<i>Eleocharis halophila</i>	saltmarsh spikerush																				
<i>Eleocharis parvula</i>	dwarf spikerush	<1	<6"																		
<i>Hibiscus moscheutos</i>	marsh mallow																				
<i>Iva frutescens</i>	big leaf sumpweed																				
<i>Juncus gerardi</i>	black grass																				
<i>Phragmites australis</i>	giant reed					<10	<6"							10	2'	10	<6"				
<i>Pluchea purpurascens</i>	saltmarsh fleabane	<1	<6"					<10	<6"					10	<6"	10	<6"	10	<6"		
<i>Salicornia europaea</i>	pickleweed																				
<i>Scirpus americanus</i>	chairush																				
<i>Scirpus robustus</i>	saltmarsh bulrush																				
<i>Solidago sempervirens</i>	seaside goldenrod	<1	<6"																		
<i>Spartina alterniflora</i>	smooth cordgrass											50	1'								
<i>Spartina patens</i>	saltmeadow cordgrass																				
<i>Spartina cynosuroides</i>	big cordgrass																				
Other Species																					
Standing Water		10																			
Fiddler Crab Holes*				30		20				15										8	
Algal Mat		50						100		50		90		90		80		50		20	
dead plant debris		30(PA)		10(PA)		<10(PA)												40(PA)			
Bare ground		10		90		90				50										50	

Wildlife Observations A snapping turtle burrowing in the mud was observed burrowing in the mud near quadrat E-5.

Notes (PA) - Approximately 90% of the dead debris was *Phragmites australis*

Q1 = quadrat number
% = percent coverage
Ht = Height (in feet or inches as noted)
* = Number per quadrat

Transect E Date 5/20/99 and 5/28/99 Investigators Dr. Joseph Shuler and Chris Koutouzakis Weather: Sunny, 60's to 70's

[illegible]

Wildlife Observations

Notes	<p><i>Scirpus robustus</i> seeds were planted in between quadrats E-13 and D-13, and in other random locations in the mitigation area.</p> <p>(PA) - Approximately 90% of the dead debris was <i>Phragmites australis</i>.</p>
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Q1 = quadral number

% = percent coverage

Ht = Height (in feet or inches as noted)

* = Number per quadrat



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